Why is Economic Geography not an Evolutionary Science?

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Abstract:

This paper explains the main commonalities and differences between neoclassical, institutional and evolutionary approaches that have been influential in economic geography during the last couple of decades. For all three approaches, we argue that they are in agreement in some respects and in conflict in other respects. While explaining to what extent and in what ways the Evolutionary Economic Geography approach differs from the Neoclassical (or 'new') Economic Geography and the Institutional Economic Geography, we can specify the value-added of economic geography as an evolutionary science. Finally, we briefly outline a research agenda of the Evolutionary Economic Geography we like to explore.

1. Introduction

Since the 'Geographical Turn' in economics (Martin, 1999, 2003), a true *Methodenstreit* has been raging in the field of economic geography. Following a seminal contribution by Krugman (1991), neoclassical economists have entered the field of economic geography (Fujita et al., 1999; Brakman et al., 2001; Fujita and Thisse, 2002; Puga 2002), yet met harsh resistance from the side of economic geographers. From the 1980s onwards, economic geography has moved away from traditional economic

analysis and has transformed into a more interdisciplinary approach using insights from social, cultural and political sciences. This turn has also been characterised by the 'Cultural Turn' (Amin and Thrift, 2000; Barnes, 2001) or the 'Institutional Turn' (Martin, 2000) in economic geography. A similar institutionalist approach exists in economics (Hodgson, 1998), yet by far not gained the support within the community of economists as it did within the community of geographers. Neoclassical economists renewing their interest in geography while geographers moving away from economics, the debate between economists and geographers has been little fruitful, and is probably best characterised by a 'dialogue between the deaf' (Martin, 2003).

Evolutionary economics as a third approach, has, however, hardly drawn attention in economic geography. Although it is noticeable that, to an increasing extent, lip service is paid to evolutionary thinking and concepts (Storper, 1997; Cooke and Morgan, 1998; Boschma and Lambooy, 1999; Martin, 1999; Sjöberg and Sjöholm, 2002), there are few systematic attempts to apply evolutionary economics into the realm of economic geography. As Martin (2003) puts it, within the context of economic geography, evolutionary economics "has yet to crystallize into a coherent body of theory and empirics" (p. 14). It is even fair to say that evolutionary economists themselves have been somewhat more active in linking evolutionary economics with geographical issues (e.g. Antonelli, 2000; Swann, 1998; Caniëls, 2000; Breschi and Lissoni 2001, 2003; Klepper 2002a). Perhaps one of the reasons of the relatively minor impact of evolutionary economics in economic geography so far, is that economic geographers tend to refer to evolutionary economics and institutional economics as one and the same (Martin, 2003). Similarly confusing is the equation of new economic geography with evolutionary economics, because of the neoclassical concept of equilibrium being an evolutionary stable equilibrium (Krugman 1996; Brakman and Garretsen 2003).

Our main objective is to outline, in a programmatic manner, the basic elements of an Evolutionary Economic Geography. Before sketching the main contours of this new approach, we will first show that an evolutionary economic geography is not reducible to the institutionalist approach neither to the neoclassical approach to economic geography. In order to do so, we first characterise the three approaches in economics (section 2). We then discuss the main similarities and differences between the three streams by making use of three recurrent debates in economics (the assumption debate, the use of mathematics, and static vs. dynamics), each of which unites two approaches and differentiates them from the third (section 3). Applying the framework to economic geography, we are able to clarify, at least to some extent, the current *Methodenstreit* between neoclassical and institutional economic geography, as well as the more constructive debates involving evolutionary contributions (section 4). While the interface between institutionalists and neoclassicals has shown to be a fertile ground for conflict, but not for exchange ('dialogue between the deaf'), developments at the interface between evolutionary and neoclassical approaches, and between institutional and evolutionary economics suggest more following. However, we will also argue that, although exchange along the interfaces is fruitful, synthesis is not expected. Rather we will argue that an evolutionary economic geography approach is unique in being characterised by core assumptions, units of analysis, and *explananda* that are different from both institutional economic geography and neoclassical economic geography (section 5). Thus, we are able to specify the value-added of the evolutionary approach and make the case that an evolutionary economic geography puts 'new wine in new bottles'.

2. Neoclassical, institutional and evolutionary approaches in economics

Though any attempt to describe and characterise the major theories in any discipline is inherently difficult, we feel it is useful as a way to differentiate a new research programme from existing ones as well as to show the linkages between the proposed research programme and more familiar lines of thought. In the context of evolutionary economics, such an attempt is even more justified as the emergence of modern evolutionary economics as a theory is to be understood as a critique of mainstream neoclassical economics, or what Nelson and Winter (1982) have described as 'orthodox theory'. Although Nelson and Winter (1982) acknowledge the danger of sketching a caricature of the neoclassical paradigm as "… a straw man or an obsolete, primitive form of economic theory" (p. 7), they criticize the neoclassical preoccupation with maximizing individuals and equilibrium analysis as the cornerstones of economic theorizing.

However, and this is where our attempt differs from most reflections on evolutionary economics, we also differentiate evolutionary economics from institutional economics even though these two theories are very often associated with one another. Illustrative is that followers of the 'old' institutional economics in the US have somewhat confusingly called themselves evolutionary economists (Hodgson, 1998). This association has largely been based on the common critiques on neoclassical economics rather than on the fundamental principles that evolutionary and institutional economics would share *per se*. For instance, both approaches build on the notion of 'bounded rationality' and 'path dependence', and account for the impact of institutions on economic behaviour in general. Few people would agree, however, that all studies gathered under the umbrella of institutional economics could equally be called evolutionary economics and *vice versa*. This is especially true for *comparative* studies in (both old and new) institutional economics dealing with alternative institutional arrangements and their comparative performance, ignoring the role of dynamics central to evolutionary economics. Conversely, a large number of influential contributions in evolutionary economists, especially in the field of industrial organisation, do not include the role of institutions at all (e.g., Winter 1984; Arthur, 1994; Klepper 1996).

To differentiate the three aforementioned theories we inevitably have to dispense with some of the nuances. Our objective is not to go into the details of each approach as such, which has been done elsewhere (Hodgson, 1998; Nelson, 1995b). In fact, the way in which we characterise neoclassical, institutional and evolutionary economics is by referring mainly to rather old or text-book versions of these theories, without claiming modern approaches to fit one of the three categories in all instances. On the contrary, our stylised differentiation of economic theorising into three approaches primarily serves a heuristic use, and allows us to investigate to what extent progress has been made on the interfaces between the three approaches.

2.1 Neoclassical economics

Neoclassical economics stands out as the most coherent and well-developed theory in economics, and possibly, in the social science in general. Following a strict definition of the Kuhnian notion of a paradigm developed within the context of the natural sciences, neoclassical economics (including game theory) is perhaps the only theory that would count as a paradigm. Its conceptual foundations can be traced to influential works by Jevons and Marshall, yet its paradigmatic form has been firmly established just after the Second World War in standard text books as the one by Samuelson published in 1948 and repeatedly

reprinted hereafter. From this period onwards, several generations of students in microeconomics and related fields have come to understood economics as a science of rational choice between given alternatives and given individual preferences. Only later, macroeconomics had been made fully compatible with neoclassical economics with the introduction of microfoundations. In this way, the working of economies and trade are deduced from individual optimising behaviour of firms and consumers.

Neoclassical theory provides predictions based on the concept of equilibrium. In its most general way, i.e. in microeconomics, macroeconomics and game theory alike, an equilibrium state (or steady state) is a state in which all individuals have no incentive to change their plans or actions. A change in model variables, or sometimes parameters, leads agents to change their plans or actions such that they find themselves in a new equilibrium. It follows that predictions can be derived from comparative static analysis of two equilibrium states, with the precise process leading the economy from one to another equilibrium state, in real time, left unspecified. A well-known example of such a comparative static analysis, is the derivation of technological substitution that will take place if relative factor prices change (criticised at an early stage, on neoclassical grounds, by Atkinson and Stiglitz 1969).

The main *explananda* of neoclassical economics, at least where micro and macroeconomics is concerned, are prices and quantities on either individual markets or in the economy as a whole, determining the allocation of economic goods and surpluses. In these analyses, neoclassical economics distinguished between different competitive settings (perfect, imperfect, monopoly) or informational settings (e.g., principal-agent). There is no need for further specification of a specific institutional setting in which actors operate, though implicit to the analysis are institutions like private property rights (Edquist and Johnson, 1997). The analysis of institutions is dealt with within the framework of game theory, which in its basic form shares utility maximization and equilibrium analysis (backward induction). It should be stressed, however, that recent developments in game theory, or experimental economics more broadly, tend to relax the assumption of utility maximization.

Another recent development, as indicated by the ‘new’ in new trade theory (Krugman, 1985), the new economic geography (Krugman, 1991) and new growth theory (Romer, 1986; Lucas, 1988), is the use of assumptions other than that of perfect competition and constant returns to scale. In the new economic geography and new trade theory, for example, increasing returns related to geographical clustering cause industries to locate or grow in ways different from the predictions based on the standard theories of comparative advantage. Still, it is fair to say that these new approaches or still in line with the two basic tenets of neoclassical theory: the assumption of utility maximizing actors and the derivation of model predictions by equilibrium analysis.

2.2 Institutional economics

Although ‘institutionalism’ has been influential in early twentieth century American economic thought (Hogdson 1998), institutional economics has never developed into a coherent, systematic paradigm. Rather, it is better described as a collection of approaches that share a common interest in explaining particular phenomena (Samuels, 1995). For most scholars adhering to institutional economics, the methodological and theoretical pluralism does not reflect incoherence. On the contrary, pluralism is to be encouraged, and is at the heart of methodology, at least if one accepts institutional economics as an interdisciplinary and contextual science (Hodgson, 1988). In its most stringent form, institutional

economics argues that differences in economic behaviour, both of firms and of regions, are primarily related to differences in institutions. These institutional differences can be present among firms (such as routines and business cultures) and among regions or countries (legal frameworks, informal rules, policies, values and norms). In essence, comparative analysis between the units comprising institutions (between firms or regions) in terms of their institutions can then be related to differences in economic outcomes, like profit, growth, income distribution or conflicts.

It should be noted that this definition of institutional economics, although present in some key contributions (Hodgson 1988), is only partial. One can distinguish between under and oversocialised accounts related to putting primacy to institutions and social class regulating individual behaviour or individuals whose rational actions result in institutions (Granovetter 1985). The 'old' institutional economics (Hodgson 1988, 1998) corresponds largely to the oversocialised account, while the 'new' institutional economics (Williamson 1985) is in line with the undersocialised account (and, in this respect, is closer to neoclassical economics). Our characterisation of institutional economics above deals primarily with the over-socialised account. In economics, however, a relatively small group of scholars adhere to the over-socialised notion of the economy as consisting of agents. By contrast, a large part of economic geography research can fairly be characterised as being closer to the oversocialised account, putting primacy at institutions rather than individual action (Gertler 1997; Amin and Thrift 1994).

Still, it must be recognised that the division between the two accounts is no longer as sharp as before. In many cases, institutional analyses do no longer explain economic behaviour from institutions alone. In fact, we will argue below that the interesting developments in economics and geography take place exactly on the interfaces between different approaches, for example, on the institutional/evolutionary interface. Still, we find it useful to characterise institutional economics as an oversocialised account as a heuristic device. Our definition stresses the central idea (or bias, if you like) that institutions determine the larger part of economic behaviour, and, consequently, differences in economic behaviour and performance can be related more or less directly to differences in institutions. We thus aim to define institutional economics as an archetype way of reasoning, rather than a coherent school of thought (which it is not).

Finally, it should also be noted that institutional economists actually have two quite different *explananda*. Apart from explaining differences in economic behaviour and performance, the change in institutions as such is also a topic regularly addressed (Hodgson 1988). As such, institutional economics is close to sociology, and is sometimes labelled as or linked to the field of economic sociology (Granovetter and Swedberg 1992).

2.3 Evolutionary economics

As with the two theoretical frameworks mentioned previously, it is far from easy to determine what is the essence of evolutionary economics. As Hodgson (1999) has put it, "there is no established consensus on what 'evolutionary economics' should mean. … a curious aspect of 'evolutionary economics' is that many people use the term as if it required little further explanation and assume that everyone knows what it means" (p. 129). It is Hodgson (1993, 1999) himself who has done a serious effort to define what evolutionary economics is all about next to other contribution including Nelson (1995) and Saviotti (1996). According to Hodgson, the object of study is novelty, or, as Saviotti puts it, qualitative change as opposed to quantitative change central to neoclassical growth theory.

A comfortable starting point is to claim that, contrary to neoclassical economics, decision-making

theory underlying evolutionary economics is based on routine behaviour rather than rational choice (Nelson and Winter 1982; Nelson 1995b). Instead of describing the behaviour of individuals or firms as if they optimise an objective function given budgetary and other constraints, evolutionary economists start from the premise that the larger part of human behaviour including organisational behaviour is routinised. In this, they follow Simon's (1955) concept of 'bounded rationality' stressing that cognitive constraints of human organisations render them incapable of optimisation in most real-world relevant situations. Consequently, individuals and firms will differ in their knowledge and beliefs, and accordingly, will show heterogeneity in their choices and behaviour (which can no longer be approximated by a 'representative agent'). It is this variety that fuels the evolutionary selection process as an open-ended and out-of-equilibrium process of economic development.

The concept of routine in evolutionary economics is still quite broadly and loosely defined, and the concept needs to be worked out more thoroughly both conceptually and empirically (on this, see Hodgson 2002). Routines can be understood as organisational skills (Nelson and Winter 1982), which cannot be reduced to the sum of individual skills. Routines are manifest at the firm level due to division-of-labour and hereby, division-of-skills between the people working for a firm. Organizational routines, as for individual skills, consist for a large part of experience knowledge (learning-by-doing) and tacit knowledge (which is hard to codify). Both aspects of organizational routines render them difficult to imitate by other firms. As a result, they are competencies to the firm that largely determine the competitiveness of a firm (Teece et al. 1997).

Adaptive behaviour of firms can take on two forms, which have been stressed by scholars at an early stage (Alchian 1950). First, firms learn from their own mistakes through trial-and-error. When routines do not work well, this failure induces active search for other routines, for example, by investing in Research and Development. The successful replacement of routines by fitter routines can be considered an innovation. Evolutionary theory predicts most firms to innovate incrementally (that is, to change routines of minor importance) to continue to exploit the knowledge built up in the past. Empirical research tends to show that where incremental innovations typically increase the life chances of firms, major organizational transformations tend to decrease the survival probabilities of firms (Anderson and Tushman 1990). Second, organisations are able to observe successful behaviour of others and try to imitate their successful routines. The difficulty here for firms is to find out which routines are crucial in explaining the success of fellow firms and, therefore, should be imitated, and which routines are detrimental for fellow firms, and therefore should be ignored. Moreover, attempts to imitate successful behaviour are failure-prone, because routines partly consist of tacit components that are hard to copy by imitators.

Apart from the intelligent, adaptive behaviour of firms as evidenced by their ability to get rid of unsuccessful routines and to exploit the opportunities of innovation and imitation, 'intelligence' also exists at the level of an industry as a whole (similar to the population level in biology). In this, evolutionary economics has similarities to the population ecology approach in organizational sociology (Carroll and Hannan 2000). As long as firms show routinised behaviour, which only sporadically changes, market competition acts as a selection device, which causes the 'smart' fit routines to diffuse and 'stupid' unfit routines to disappear. The assumption of routinised behaviour is crucial because selection for fitter routines can only take place if the speed of change of organizations is substantially lower than the time-span of selection. A number of processes render fitter routines to become more dominant in an industry, including differential growth of firms (Alchain 1950; Nelson and Winter 1982), imitation (Alchain 1950; Nelson and Winter 1982), labour mobility, and through spin-offs (Klepper 2002a,b).

The explanandum of evolutionary economics is how the differential growth or reproduction of entities can be explained. Typically, but not exclusively, evolutionary economists deal with differential success of firms, including why older firms have higher survival probabilities (Klepper 2002a,b), yet may suddenly become extinct as a result of radical innovation (Anderson and Tushman 1990). Understandably, evolutionary economics has had most impact in the fields of industrial organisation, organisation theory and management studies. Other examples of evolutionary processes of differential growth include technological change (Grübler 1990; Saviotti 1996; Frenken and Nuvolari 2004), economic geography (Boschma and Lambooy 1999), and economic growth, structural change and long waves (Pasinetti 1981; Freeman and Perez 1988).

Where evolutionary economics differs from the older neoclassical and institutional schools of thought is that economic actions of agents, be them firms, consumers or governments, can not be explained by perfectly known costs and benefits (as in neoclassical economics), neither by institutions followed automatically and by all (as in our definition of institutional economics). Rather, routines, learned in the past and determining current competitiveness, determine action, and being learned primarily within the boundaries of a firm, routines are largely firm-specific. Being exposed to economic selection environments and social institutions, surviving firms are characterised by routines that are more or less adapted to scarcity conditions and the wider institutional framework. Crucially, routines can be changed, either by chance or intentionally, such that new varieties are introduced and survival probabilities of the entities in question will shift.

Table 1. Three approaches in economics

Neoclassical	**Institutional**	**Evolutionary**
Deductive	Inductive	Both
A-contextual	Contextual	Contextual
Optimising agents	Rule-following agents	Satisficing agents
Equilibrium analysis	Comparative analysis	Out-of-equilibrium analysis
Micro-to-macro	Macro-to-micro	Recursive
Allocation	Coordination	Evolution
Quantitative change	Institutional change	Qualitative change

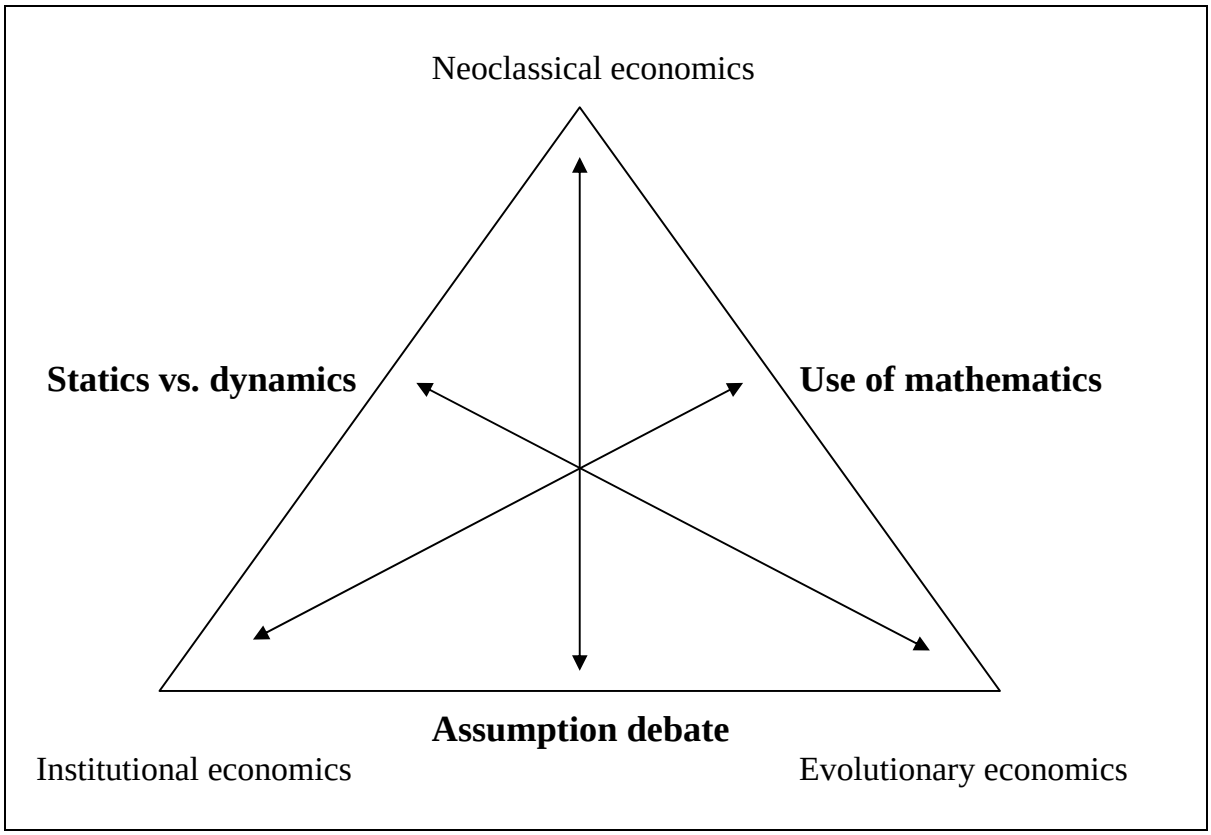
3. Debates

There are a number of recurrent debates in economics, which can be positioned within the triangle of the three approaches in economics. The recurrence of debates may well have to do with the parallel, and largely independent, dynamics of sub-disciplines within the economics profession. For example, debates between neoclassical and evolutionary scholars started in the context of the functioning of markets (Winter 1964), and only later focused on growth theory (Nelson and Winter 1974, 1975), on innovation theory (Nelson and Winter 1977; Sahal 1981), on international trade theory (Dosi et al. 1990), on institutions (Freeman and Perez 1988; Nelson 1995a), on the theory of the firm (Teece et al. 1997), and on economic geography (Boschma and Lambooy 1999). We discuss these debates in the context of post-war economic theory as to shed a new light on the recent debate in economics geography between neoclassical

economists advocating a ‘new economic geography’ and economic geographers adhering to institutionalist concepts and methodologies. We will proceed by first discussing the three debates in economics, and only then discussing the current *Methodenstreit* in economic geography.

Though primarily for heuristic reasons, and without any claim to summarise these various debates accurately, we distinguish between three main debates. As illustrated in Figure 1, each of these debates ‘unites’ two of the three approaches and differentiates them from the third. The first debate centres on, what has become known as, the assumption debate. Evolutionary and institutional economists have criticized the neoclassical assumptions of maximizing individuals with perfect information. The second debate concerns the usefulness of mathematical modelling which unites, to some extent, evolutionary and neoclassical scholars, but which is opposed almost by nature by most institutionalists. The third recurrent debate has been labelled ‘statics versus dynamics’. Here evolutionary approaches take a critical stand toward the static analyses of neoclassical and institutionalist approaches. Again, we would like to stress that the differentiation of economic theorising in three approachs solely serves a heuristic purpose. In fact, recent theorising in economics seems to occur at interfaces between two theories rather than purely within a theory. For example, experimental economics not only focuses on strategic rational choice behaviour, but also how emotions and routines affect decision-making. And game theory recently shifted from static analysis (backward induction) to evolutionary analysis (learning by trial and error) (Friedman, 1998).

Figure 1. Three debates within the triangle of neoclassical, institutional, and evolutionary economics



3.1 The assumption debate

The first debate concerns the assumption debate centred on the assumptions that agents maximize some objective under the assumption of complete information on all relevant data. Both evolutionary and institutional economists have criticised at various occasions the poor descriptive value of the neoclassical assumptions of utility-maximizing individuals (including profit-maximizing firms) under a regime of perfect information. As Dosi (1984) put it, "we must abandon the neoclassical framework because we cannot assume an exogenous and given context and many God-like actors who behave in accordance with a uniform rationality" (p. 107). By contrast, evolutionary and institutional economists claim that individual behaviour is guided by routines and institutions that provide the basis for decision-making in an inherently uncertain environment (Veblen 1898; Simon 1955; Nelson and Winter 1982). As such, they reject the atomistic view of economic actors that ignores the contextuality of human action, which is, at best, held constant. This is not to say that evolutionary and institutional economists assume that agents do not wish to maximize utility and profits, but that real-world agents are not able to do so.

Though there are multiple ways to approach this long standing debate in the history of economics, a convenient starting point is the 'marginalist controversy' in the late 1940s (Vromen 1995). This debate focused on the question whether business men really behaved according to the neoclassical assumption that firms maximise profits, and in order to do so, equal marginal benefits to marginal costs. Empirical research showed that business men used rules of thumb rather than precise calculation of marginal benefits and marginal costs. One such rule of thumb is to determine the price from the average costs plus a mark up. This debate, however, quickly resolved when Alchian (1950) and Friedman (1953) argued that the question whether or not firms maximise profits is not the relevant question to ask. In reality, firms may decide in different ways on the technologies they use, the quantities they produce and the prices they set. Following Nelson and Winter (1982), one can use the term business *routines* to refer to the whole set of decision procedures and technologies a firm uses. From this heterogeneity in business routines, firms that act closest according to the prescriptions of neoclassical theory will then make most profits, while other firms make losses. As a result, through an evolutionary process of selection, firms with routines producing behaviour that is closest to the prescriptions of neoclassical theory for profit maximisation, will drive out firms that do not. This process takes place irrespective of the way in which firms come to these decisions. Different from natural selection in biology, however, economic selection need not take place through differential reproduction rates (the analogy being spin-off companies), but also through different growth rates of firms and imitation of firms with successful routines by firms with less successful routines. Also note that an evolutionary reasoning applied to business routines requires these routines to be invariant over time.

In this view, neoclassical theory is still useful as a predictive theory. For example, neoclassical theory predicts that a change in factor prices will lead firms to change their technologies such that the factor that has become more expensive is less used as an input. Although this prediction is derived by assuming firms to maximise profits, which they do not, the prediction of factor substitution may well be right, as firms adopting a technology that makes less use of the factor that has become more expensive, will prosper and other firms will face losses. By invoking an evolutionary reasoning to defend the neoclassical theory of

production, Alchian (1950) and Friedman (1953) took an instrumentalist stance towards economics as a science. Their argumentation holds that, shortly stated, the assumptions of a theory need not be realistic as long as the hypotheses derived from the theory are helpful in predicting the future.

Ironically, Friedman's use of the theory of natural selection to defend neoclassical economics has probably accelerated to development of evolutionary economics as an alternative to neoclassical economics. Not long after Friedman's (1953) essay, scholars argued if economic 'natural selection' underlies the economy, economic theory should explicitly model the economy as an evolutionary process rather than implicitly assuming this to be the case (Koopmans 1957; Winter 1964). This position is in line with realism, as opposed to instrumentalism, in that evolutionary models try to unravel the precise mechanisms driving change. Put differently, scholars adhering to realism are primarily interested in understanding the underlying mechanism in society, and only secondarily in prediction (which is inherently difficult due to the sheer complexity of social and economic life). In this light, the most important contribution to evolutionary economics has been the seminal work by Nelson and Winter (1982). They showed that an important part of neoclassical theory can indeed be formally reformulated as an evolutionary theory of economic change. A core assumption in their work has been that firms are bounded rational (Simon 1955), and react to their economic environment according to routines rather than through maximisation of profits. From this, it follows that the competitiveness of firms depends on their capability to improve their routines through innovation *over time*. Put differently, where neoclassical economics deals with price competition and static efficiency, evolutionary economics deals with Schumpeterian competition and dynamic efficiency (Schumpeter 1942). This explains why evolutionary economics is also called neo- or post-Schumpeterian economics (Andersen 1994), and since have focused on Schumpeterian themes as technological development, industrial organisation, and long-term macroeconomic growth.

3.2 The mathematics debate

The second debate unites evolutionary scholars with neoclassicals, and differentiates them from institutional economists. The debate centres around the role of mathematical modelling in economics, or perhaps more accurately, in social science in general. Where evolutionary and neoclassical economists frequently formalise ideas in abstract modelling, the majority of institutionalists rejects the use of modelling, because it does not capture the contextual nature of economic life, and life in general (Hodgson, 1998; Martin, 2000). This rejection of the use of formal mathematical models is not true for all proponents of institutional economics. Hodgson (1998) summarised the attitude of institutional economists toward mathematical modelling as follows: " … mathematical and statistical techniques are recognized as the servants of, rather than the essence of economic theory" (p. 173). In doing so, they criticise the neo-classical attitude to exclude those factors from their analysis that might be relevant (such as institutional factors), but cannot be formalised and expressed in mathematical forms within a maximization-equilibrium framework.

Evolutionary economics, though critical towards the exact assumptions used in neoclassical models, do not reject the use of mathematical modelling as such. Mistakenly, the use of mathematics has been confused with an anti-realist modelling. As argued by Mäki (1992) on various occasions, abstracting from specifics by formalising particular economic mechanism does not necessarily imply an instrumentalist position on models as tools for prediction. Mathematical modelling can also serve a realist program aimed

to unravel fundamental mechanisms from mechanisms or context that is only of secondary importance. In this vain, Nelson and Winter (1982), Winter (1984), Klepper (1996) and others have turned to models as a means to verify inductively generated ideas, and to derive propositions from them that can be tested in a relative unambiguous manner. Typically, econometric tests in evolutionary economics make use of historical time series (Klepper 2002a,b), rather than in a predictive manner as advocated by Friedman. The emergence of what is called *applied evolutionary economics* (Saviotti, 2003) marks the importance attached to the further development of evolutionary econometric techniques.

Neoclassical and evolutionary approaches thus agree on the importance of formal theorising, yet apply these models in slightly different manners. What is more, evolutionary economics also makes use of other modes of theorising summarised by Nelson and Winter (1982) as *appreciative* styles of theorising (p. 46). They make a strong argument in favour of finding a sort of balance between formal and appreciative theorizing, the latter being more inductive making use of stylised facts. In practice, one can observe that, broadly speaking, evolutionary economics is evolving into three main methodological directions. The first is focussed on abstract, formal modelling. In this respect, it is rather ironic to see that the evolutionary approach runs the risk of falling prey to the same weakness of the neo-classical theory defined by Nelson and Winter (1982) more than twenty years ago, that is, building 'a rococo logical palace on loose empirical sand' (p. 33). The second is focussed on more descriptive, empirical studies, as illustrated, for example, by the 'Innovation System' literature (Freeman, 1987; Lundvall, 1988; Nelson, 1993). These kind of studies make an attempt to analyze the innovation process in a territory in terms of what kind of organizations are involved, what kind of interaction patterns exist, and how these are embedded in a particular institutional setting (Edquist, 1997; Cooke et al. 1998). The third tries to find a sort of balance between these two extreme methodological positions.

3.3 Static versus dynamics

Characteristic for evolutionary theory, be it as a theory of natural history in biology, as a theory of learning in artificial intelligence, or as a theory of economic development in economics, holds that it explains processes of qualitative change. Essentially, evolutionary theory asks the question how a current state of affairs can be explained from history, i.e., as an interplay between accumulating structure (e.g., genes, routines) and selection conditions prevailing during history. The current state of affairs cannot be derived from current conditions only, since the current state of affairs has emerged from, and has been constrained by, previous state of affairs. This is why history matters (David, 1985).

For example, consider two regions that are equal in terms of factor prices and in terms of institutions. Still, it is perfectly possible that in each region a different technology is used, because at the time of adoption selective conditions were different. Being used hereafter for a sustained period of time, learning has been localised in this technology only (Atkinson and Stiglitz, 1969). The technology has become entrenched in the cognition and routines of agents, and has co-evolved with interrelated technology and institutions. Jointly, technological and institutional structures thus develop in a path dependent manner. Similarly, at a micro level, two firms that are subject to the same selection environment can adopt very different technologies if selective conditions have been different at the time of adoption. Hereafter, learning and innovation have been localised in their specific technology, and only partially spills over to other firms. And, technology and organisational structures mutually adapt in the course of time in firm-specific manner, explaining why firm heterogeneity is persistent. These are only two examples of

evolutionary trajectories of development, at the level of regions and firms, which suggest that a static analysis cannot reveal differences that are the result of localised trajectories of development in the past.

In this respect, evolutionary economics differs in a fundamental sense from the static approaches of neoclassical and institutional economics. The latter two approaches, at least in their archetype form, explain differences from either different in factor conditions or differences in institutional set-ups. In this respect, neoclassical and institutional economics share a comparative approach, which is perhaps best illustrated by the debate surrounding economic growth. Considering regional income, neoclassical economics approaches the matter by assuming advanced countries characterised by the highest labour productivity, and lagging countries that automatically will converge as technology diffuses as a public good, and as capital moves to lagging countries and labour to the advanced countries. The absence of full convergence, and the question how regional differences emerged in the first place, has led to neoclassical growth theorists to introduce some notion of externalities (possibly spatially bounded) in ´new´ growth models. Differences in, for example, human capital can then explain some part of the unexplained variance, yet fail to capture the qualitative differences in development, both technologically and institutionally. Or, as Martin and Sunley (1998) have put it, "… the models treat externalities in a general and abstract manner and, in relating them to the *rate* of technological progress or economic growth, they do not consider the actual *direction* or trajectory of these processes" (p.216).

An institutionalist (Weberian) approach takes the existing qualitative differences in institutions as its point of departure. Differences in regional income can then be explained from differences in institutions, with the more advanced countries being characterised by different institutions than less advanced countries. The institutions supporting growth can be derived from cross-sectional analysis with institutions as explanatory variables. A related mode of analysis is that of business systems (Whitley REF), which characterises nations by their specific business institutions. Though such an approach precisely acknowledges qualitative differences between countries, it does not capture the path dependent specificity of technological development, learning and institutional change. Rather, it runs the risk of adopting a 'best practice' logic suggesting that institutions from successful regions can be transplanted to a new context, and, if so, produce the same beneficial outcomes.

Again, with respect to institutional economists, we do not claim that all institutional economists headed under the umbrella of institutional economics use comparative analysis only. On the contrary, many people advocating institutionalist analysis have stressed the historical specificity of economic development, and, the possibility that multiple trajectories of development exist rather than one ideal-type of economic growth. Hodgson (1998), for example, stresses that institutional economics does not only involve comparative studies on different institutional regimes with different economic performance, but also institutional *change*, and, very often, institutional change as an evolutionary process. Some, including Samuels (1995), even characterise institutionalism as an evolutionary approach, due to its emphasis on process and evolution: "Veblenian evolutionism is Darwinian in having neither cause of causes nor predetermined end state; it is non-teleological and open-ended" (p. 580). Still, institutions being explained and explanatory, it remains unclear what are the drivers of institutional change (unless one adopts a teleological approach after all).

It is important to recognise, however, that although some proponents of institutional economics make use of evolutionary theorising, one can still argue that the two approaches do not overlap as they differ in their *explanandum*. Institutional economists are interested in explaining institutional change, and how this in turn affects economic life, while evolutionary economists are after explaining technological change and

industrial dynamics, and economic growth in terms of structural change (not from institutions). Typically, if institutions are taken into account by evolutionary economics at all, it is done insofar these institutions affect the innovative capabilities of actors in specific industries and how these institutions change endogenously as a response to innovation. Institutional change is thus explained by frictions occurring from technological and economic dynamics, while, at the same time, newly emerging institutions in turn affect the further techno/economic development (Freeman and Perez, 1988). It is in this context that Nelson's (1995a) notion of co-evolving technologies, industries and institutions is especially relevant.

Importantly, institutional change in evolutionary studies is analysed at the industry level, and more often than note, institutions turn out to be more specific to industries than to nations. Consequently, it becomes problematic to delineate localities (regions, nations) by alleged shared institutions, because within localities considerable institutional variety exists between sectors. As a consequence, evolutionary economics concentrates more on institutions evolving around particular technology fields or sectors, rather than within specific spatial units. Put differently, institutional homogeneity should not be assumed a priori, as do many institutional economists, but remains an empirical question.

4. *Methodenstreit* and other interface developments in economic geography

As stated in the introduction, economic geography is subject to a lot of turmoil during the last fifteen years or so. If any 'revolution' has hit economic geography recently, it must be the application of neoclassical economics on matters of economic geography by Krugman and others. We will refer to this research programme as neoclassical economic geography, which includes regional science based on general equilibrium models as well as 'geographical economics', following the terminology of Brakman et al. (2001). From now, we avoid using the term 'new economic geography', a term proposed by Krugman, because Krugman's models are 'neither new, nor geography' (Martin, 1999). Rather, Krugman's approach fits within a tradition known as regional science, which bifurcated from economic geography somewhere during the seventies (so one could speak of the 'new regional science').

The basic contribution of Krugman has been to show that, within a neoclassical framework of utility/profit maximising agents, agglomeration can occur in a world of homogenous regions. In particular, with transportation costs falling, a critical transition point is reached where both firms and workers found it more profitable to cluster in one region rather than to spread out over more regions. The main driver is the balance between internal scale economies for firms and economies of product variety for consumers related to clustering, and inter-regional transportation costs on the other hand. What is more, the core model of Krugman (1991) has been shown to be extendable in many directions, including other factors such as congestion and unemployment (Fujita et al., 1999; Brakman et al., 2001; Fujita and Thisse, 2002; Puga 2002).

Not long before Krugman (1991) and colleagues took economic geographers by surprise, the community of economic geographers itself had undergone an important reorientation. We refer to this change as the institutional (or cultural) turn in economic geography, although one is reminded that there is not (yet) a fully articulated 'institutional economic geography approach' (Martin, 2000). Institutionalist approaches to economic geography share a focus on the nature, impact and evolution of institutions in different places, in particular, cities, regions and nations. In this respect, one can view the institutionalist

turn in economic geography as the successful development of the programme of institutional economists, which have little success within the boundaries of the economics profession hitherto.

As depicted in Figure 2, we posit that a trend of theorising at interfaces is taking place in economic geography. The main debate so far has been taking place between what we would describe as neoclassical and institutionalist economic geographers (Amin and Thrift 2000; Martin and Sunley 2001), and we agree with Martin (2003) that it has led to little fruitful exchange of ideas so far. In Figure 2, we have made this clear by observing a clash between neoclassical and institutionalist economic geography. Where geographers apply an inductive, and often, case-study research approach, signalling out the local specificity of 'real places', economists approach the matter deductively and mathematically starting from 'first principles' (equilibrium analysis) and core assumptions (utility maximization). By starting from 'neutral spaces', geographical economists abstract from local specificity and particular spatial level of aggregation. Progressively, they complexify their models to incorporate more relevant mechanisms, yet hold on to spatially neutral spaces, and to the first principles and core assumptions characterising neoclassical economics.

Going back to the main debates discussed in the previous section, we can understand the clash of geographical economists and economic geographers as reflecting two incommensurabilities. First, the two approaches differ in their methodology: institutional economists dismiss *a priori* the use of mathematical modelling and econometric specification derived from these. By contrast, neoclassical economics do not value the method of case study highlighting locally specific patterns of economic life (e.g., Overman, 2003). Second, the two approaches differ in their core assumptions underlying their explanations of economic phenomena. Institutions being embedded in geographically localised practices, they form the prime subject of economic geography, as institutional specificity largely determines the local economic patterns. By contrast, institutions play no role in neoclassical models, or only in a loose and implicit sense (e.g., relating to particular parameters in the model). Local institutional and cultural factors are left out of the analysis are not regarded as essential to an economic explanation, and are 'best left to the sociologists', as Krugman once put it.[1] What is more, the recent wave of mathematical models develop by neoclassical economic geographers does not even require differences between regions to exist (be it institutional differences of different in factor prices). Rather, the models start from a 'neutral space', and aim to explain how agglomeration can *occur* from this, i.e. how uneven patterns can emerge from an initially uniform world. This has been called 'putty-clay geography' by Fujita and Thisse (1996): "there is a priori considerable uncertainty and flexibility in where particular activities locate, but once spatial differences take shape they become quite rigid" (Martin, 1999, p. 70).

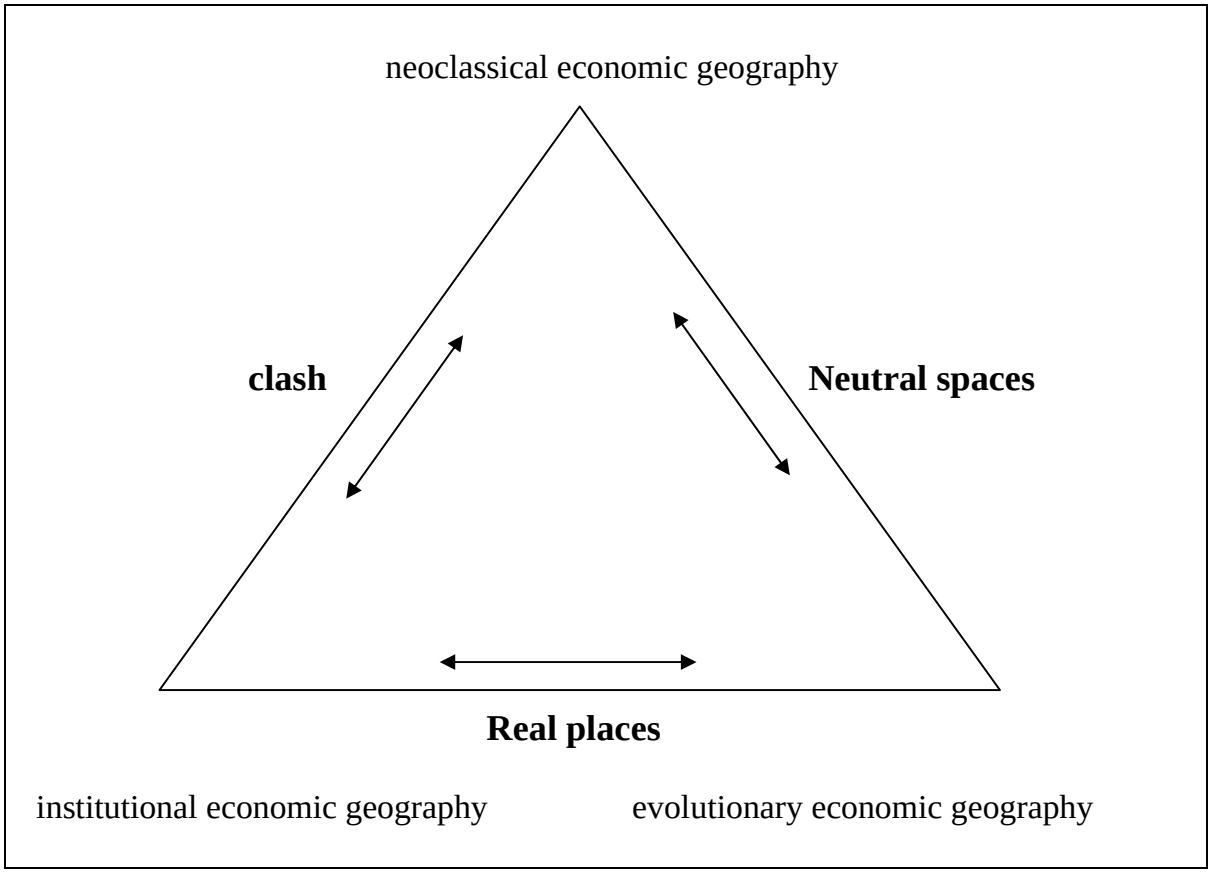
We would argue that evolutionary economics is in a way linking the two approaches, as the methodological and theoretical differences that underlie the clash between institutional and neoclassical economics, are precisely the aspects that unite evolutionary economics to the two approaches. As explained earlier, the use of formal modelling is supported by evolutionary economics as a way to verify intuition and to derive precise hypotheses to be put to the test. In the context of economic geography, evolutionary economics meets the neoclassical approach is in starting out with a uniform world and in

[1] Note that the exclusion of institutions in geographical economics does not render this theory instrumentalist per se. Where institutional economic geography and geographical economics differ is on the essential mechanisms underlying economic phenomena. As argued by Marchionni (2004), Krugman is best regarded as a realist that uses models as a research strategy to come closer to unravelling the complexity of the economy rather than an instrumentalist that judge models primarily on the basis of its predictive value.

examining how uneven spatial distributions of economic activity emerge in a path dependent manner from these neutral spaces. Thus, although the precise modelling techniques and underlying theoretical assumptions greatly differ, both evolutionary and neoclassical approaches of economic geography stress the use of formal models explaining how regional differences come about. Note that this research questions differs from comparative institutional analysis, in which the regional differences are explanatory factors rather than the issue to be explained.

Whereas evolutionary economics shares the methodology of formal modelling with neoclassical economics, it does not share the main theoretical assumptions underling neoclassical models. Rather, Evolutionary economics has introduced an own set of assumptions, each of which replaces a core assumption of neoclassical economics (heterogeneity instead of the representative agent, Knightian uncertainty rather than perfect information, satisficing rather than maximisation). In this view, the specific set of institutions that agents are subjected to also affect their behaviour and success. These institutions operate both at the micro-level, as reflected in the central concept of routines guiding firm behaviour, as well as at the macro-level, as reflected in the concept of innovation systems for example. Thus, in line with the institutional approach, evolutionary economics acknowledges the importance of institutions in explaining economic behaviour and difference herein between regions (i.e. 'real places').

Figure 3. Interfaces within the triangle of economic geography approaches



Given the methodological similarities between the evolutionary and the neoclassical approach, and the theoretical similarities between the evolutionary and institutional approach, one can expect the exchange of ideas along these two interfaces to be most fruitful in economic geography. We will therefore explore in more detail some of the recent contributions along these interfaces.

4.1 The interface between neoclassical economic geography and evolutionary economic geography

In recent years, the main contribution of neoclassical economics to economic geography has been the development of a new family of models, based on Krugman's (1991) core model, commonly headed under the label of 'new economic geography'. As these models are better understood as economic models treating only some aspects of geography (in particular transportation costs), some prefer the label of 'geographical economics' (Brakman et al. 2001) instead of 'new economic geography'. Though the new economic geography has been attacked on various occasions by economic geographers and others (Martin and Sunley 1996; David 1999; Martin 1999; Amin and Thrift 2000; Nijkamp 2001), it can be considered an important contribution to our theoretical understanding of possible mechanisms creating uneven spatial development. Moreover, as the new economic geography is firmly based in neoclassical economics, using the same core assumptions, it also provide a way to connect issues of geography to other areas covered by neoclassical economics. Our aim is not to discuss neoclassical economic geography in any depth. In the following, we explain that, despite different assumptions and micro-foundations, the new economic geography often comes to similar conclusions as evolutionary theory. At the same time, we make clear it would be wrong to assume that convergence between the two approaches will necessarily occur. We go into the similarities and differences using the three debates outlined in Figure 2: evolutionary and neoclassical approaches share a common methodology of modelling, yet differ in assumptions and in the treatment of static and dynamics.

The new economic geography can be considered a recent extension of neoclassical economic geography, relaxing, for instance, the standard assumptions of perfect competition and constant returns to scale. It is basically a 'micro-economic theory of spatial agglomeration' (Martin, 2003). In doing so, it reintroduces agglomeration economies as a self-reinforcing process of cumulative causation that results in spatial concentration of economic activities. As evolutionary approaches, the new economic geography differs in important respects from the traditional neoclassical approaches that typically involve models of a-historical and reversible processes with an unique spatial equilibrium. In this sense, it shares a number of features with evolutionary modelling, such as the possibility of multiple outcomes of spatial concentration of economic activity, path dependence in the process leading to one of possible outcomes, irreversibility of outcomes leading the economic system to lock-in, and the possibility of sub-optimal outcomes as end result. Moreover, both approaches are keen on explaining how uneven spatial patterns emerge from neutral uniform spaces. For example, the Polya urn model underlying some evolutionary models (Arthur 1994), applied to the spatial evolution of a new industry, assumes that initially, firms can emerge in any region with equal probability. However, new firms being modelled as spin-offs of existing firms, uneven distributions of firms will emerge automatically. This fundamental mechanism driving both the birth of an industry and its spatial distribution, also underlies a recent paper by Klepper (2002a) explaining how Detroit became the capital of the U.S. car industry from spin-off dynamics alone. Using a recent evolutionary approach based on graph theory (Barabasi and Albert 1999), one can also take

spatially defined nodes as the unit of analysis, and analyse how skewed distributions in city size or land values can emerge resulting from network economies resulting from a node's connectivity (Andersson et al., 2003, 2004). Again, one is interested in explaining observable skewed distributions from an evolutionary process emerging endogenously from an initially spatially uniform world. Thus, although the precise modelling techniques and underlying theoretical assumptions greatly differ, both evolutionary and neoclassical approaches of economic geography use formal models to explain the emergence of uneven distributions in an initially even world.

As explained earlier, the new economic geography remains firmly within the neoclassical framework, as witnessed in assumptions like the assumption of profit/utility maximisation, representative agents, given technology, and static market structures. In this, it differs greatly from evolutionary theory that is based on a different set of assumptions. In short, evolutionary economic geography assumes that firms compete on the basis of their knowledge, routines and competences that are built up in the past (and within a particular local environment) and that are hard to imitate by competitors. Following this reasoning, the emergence of spatial agglomeration is not analysed as stemming from rational location decision of firms and consumers, but from historically grown concentration of geographically localised knowledge. This knowledge is primarily embodied within the routine of firms, but also within a firm's relationships with other firms and other actors. While the new economic geography focuses attention on factor costs, and the trade-off between transportation costs and internal economies of scale, the evolutionary approach focuses dynamics on firm learning and knowledge spillovers between firms the two main sources of agglomeration.

Put differently, the evolutionary approach is interested in exploring the explicit mechanisms of *knowledge production* within the firm mainly resulting from R&D and learning-by-doing (Nelson and Winter 1982; Klepper 1996), and of *knowledge transfer*, through imitation, spin-offs, social networks, labour mobility, collaborative networking, etc. In doing so, evolutionary approaches assume that an important part of agglomeration economies are caused by knowledge spillovers as a vehicle of diffusion of routines and competences, and to what extent proximity facilitates these knowledge spillovers to happen (Jaffe et al. 1993; Feldman 1999; Antonelli, 2000; Breschi and Lissoni, 2002). In this context, regional differences are dependent on, though not fully explained by, place-specific institutions that affect the incentives of agents to share knowledge and to engage in collaborative projects.

By contrast, the new economic geography does not deal with the specifics of industry dynamics, knowledge spillovers and institutional factors when analysing the degree of spatial agglomeration, partly because institutional factors are difficult to introduce in formal analysis ('best left to the sociologists', as Krugman once put it). Due to their neglect of industrial dynamics, the new economic geography has not the ambition to explain the location of particular industries (Krugman 1991). Therefore, Martin (1999) is right that the new economic geography is "… unable to tell where it (industrial localization and specialization) occurs, or why in particular places and not in others" (p. 78). We would argue that the aim of an evolutionary approach is to do just that: it analyses the spatial evolution of a population of non-identical firms with different routines in a particular industry, rather than the spatial pattern of economic activities in general.

Apart from the theoretical differences between evolutionary and neoclassical approaches to economic geography, the treatment of dynamics in both theories is different as well. Although the new economic geography models are often interpreted as reflecting the formation of cities, it still bases its conclusions on a static account of equilibrium. Model outcomes are derived by computing, for all individual agents, their

location choice such that their joint actions are in equilibrium. As noted by Krugman (1996) and Brakman and Garretsen (2003, footnote 14), the concept of equilibrium underlying the models of new economic geography is close to the concept of Nash-equilibrium in an evolutionary game: an equilibrium is characterised by a set of actions such that, given this set, no individual has an incentive to do otherwise. This means that a model is analysed by looking at Nash-equilibria (the stable ones usually being all firms being all located in city 1 or all in city 2). A change in equilibria is 'caused' solely by a change in the exogenous parameters, i.e. outside the model setting. This differs from evolutionary models, in which not only the set of actions of firms is analysed, but also endogenous changes in the possible set of actions occurring over time (due to innovation). In this view, economic dynamics may only show temporary convergence to equilibria, which are continuously being 'upset' by deviant innovative behaviour by some firms in the population. What is more, the disequilibrium tendency caused by deviant behaviour is not regarded as 'noise' but as the fundamental drive underlying economic development. Firms have an incentive to deviate, especially when a tendency towards equilibria is present and profits are shrinking. Following Schumpeter (1934, 1939, 1942), evolutionary economists view the search for supra-normal profits by innovation caused by technological competition is seen as the primary dynamic in the economy (moving away from equilibria), and the erosion of profits due to price competition as a secondary dynamic (converging to equilibria).

4.2 The interface between institutional economic geography and evolutionary economic geography

As stated earlier, it is quite common that institutional and evolutionary approaches are treated as one and the same by geographers. This may have something to do with the rejection of the neoclassical paradigm by both approaches, which is widely supported by economic geographers. This may, for example, be illustrated by the fact that neoclassically based institutional thinking a al Williamson, which is an established and influential field in economics, has hardly found any supporters in economic geography (one exception being Scott 1993). However, we claim it would be confusing, wrong and misleading to equate institutionalist and evolutionary approaches in economic geography, and we argue that the approaches can be considered as being rather different. We make use again of the three debates outlined in Figure 2 in order to explain why. With respect to the methodological debate, quite substantial differences remain between the institutional and evolutionary approach, because the latter approach tends to employ more quantitative and analytical tools. Interestingly though, there is increasing opposition from within the institutional economic geography itself, pleading for more rigour analyses (Martin and Sunley, 2000; Taylor, 2004). Institutional and evolutionary approaches, however, agree on geographical specificity and the important of context, and both criticise the neoclassical view for ignoring this. With respect to the 'static versus dynamics' debate, institutional approaches rely heavily on comparative analyses while evolutionary approaches favour longitudinal analyses. Nevertheless, although both approaches recognise the importance of path-dependent processes, they do so in different ways, especially with regard to the type of change involved.

As explained earlier, institutional approaches take a critical stand toward abstract, formal theorising, as employed by neoclassical economics, and, to a lesser extent, by evolutionary economics. In institutional economic geography, descriptive analyses are the rule rather than the exception. Regional development being regarded as a complex and multi-faceted phenomenon, it can only be understood using anti-reductionist methodologies. In particular case studies research based on a variety of qualitative techniques

are applied, the precise mix of methodologies depending on the issue at hand. The use of these methodologies more or less follows from the nature of theorising. For example, cultural geography is firmly based in postmodern sociology and anthropology, and from its theoretical premises follows a methodological approach based on qualitative fieldwork methods or textual analysis. However, in some cases the core concepts of theoretical contributions turn out to be very hard to operationalise also in qualitative research designs. For example, the notion of 'institutional thickness' (Amin and Thrift, 1992; Keeble et al. 1999) has been highly influential as a concept in economic geography, but has also been heavily criticised for being vague concept, which can not be accurately measured, let alone that its impact on regional development can be determined and tested (Markusen, 1999; Taylor, 2004). More generally, according to some criticasters, empirical institutionalist approaches show 'a lack of rigour, lack of hypothesis testing and ill-defined concepts' (Martin, 2003, p. 36).[2] The contributions of institutional approaches in economic geography have thus been, primarily and most importantly, theoretical by suggesting new explanations and mechanisms underlying regional development and the role of institutions, and in terms of policy, by opening up new discourses, e.g., on the cultural meaning of places and heritage, and the limited transferability of locally rooted economic production (e.g., Gertler 1997).

It is also important to note that the use of qualitative research methods does not follow from theoretical premises in all instances. For instance, recent network approaches in institutional economic geography, including the embeddedness literature and relational economic geography, can, in principle, very well use quantitative empirical network techniques from quantitative sociology (Burt 1982), and formal modelling techniques from graph theory (Albert and Barabasi 1999; Barabasi 2002).[3] However, in their programmatic contribution on relational economic geography, Boggs and Rantisi (2003) argued that 'being relational in practice' implies, as a rule, a case study approach. Thus, some authors seem to have a priori objections to the use of quantitative tools, even if theoretical contributions allows for their fruitful application. It this context, Markusen's (2003) reply to a number of institutional economic geographers, in which she pleas to go beyond the oppositional distinction between inductive or deductive research, or between qualitative or quantitative research, is worth mentioning.

In evolutionary economic geography, quantitative analyses are more common. Taking firms as the unit of analysis, a natural approach to economic geography is to adopt demographic techniques describing the entry and exit of firms, and how survival depends on age, location and ancestry (parent company). A recent example of econometric testing of evolutionary models has been Klepper's (2002a) study of the American car industry. In this way, one can assess whether spatial concentration is solely the result of an endogenous spin-off dynamic, or whether regional differences explain part of the variation in firm's success as well. A second methodology, more appropriate to capture spillovers as a source of agglomeration, is based on graph theory and network analysis. Recent advances in these fields have made it possible to discriminate between social network distance and pure geographical distance as determinants of knowledge spillovers (Breschi and Lissoni 2002). By doing so, the black box of knowledge spillovers is opened, and understanding is gained to what extent spillovers truly emerge from proximity per se, and to what extent spillovers are bounded by social networks (club goods). Again, one is interested in whether

[2] Though cultural studies have become well developed and established in sociology and anthropology, some have suggested that it still suffers from 'conceptual imprecision, theoretical ambiguity and empirical open-endedness' in economic geography Martin and Sunley (2000, p. 10).

[3] An example study in this vein is a recent study by Baum et al. (2003) on networking between Canadian investment banks using network analysis.

and in what way geography matters, rather than pre-assuming its matters in all cases. Also note that, in evolutionary analysis, one does not determine *a priori* at which spatial level the analysis should be carried out. Instead, the relevant spatial level is an outcome of the empirical analysis itself. This can be realised when applying a multi-level approach (e.g., using spatial autocorrelation techniques), in which data at various spatial scales have to determine at which spatial levels particular local phenomena can be best explained (Van Oort 2002). This would complement previous multi-level approaches assessing the impact of different degrees of openness (in terms of a ratio local/non-local linkages) on regional development (Asheim and Isaksen, 2002; Bathelt et al. 2003).

Institutional and evolutionary economics have some methodological differences, yet substantially they share important assumptions and ideas. These have already been discussed above in the context of economic theory more generally. In the context of economic geography, the most important idea is to view place as a context constraining behaviour *viz.* the notion of 'real places'. In evolutionary economics, this notion is known in a more specific context, that of innovation systems. Each territory has a unique set of characteristics, including identity, resources, institutions, industry-mix and relations within and outside the region. Consequently, the universalistic account of economic geography advocated by neoclassicals is rejected. Even is one would accept the view that the new economic geography allows for historical specificity and path dependence, this is an outcome of spatial process and not of differences in territories. As Martin puts it (1999), history is not regarded as 'real history': "there is no sense of the real and context-specific periods of time over which spatial agglomerations have evolved" (p. 76). An institutionalist view stresses that spatial outcomes are not solely the outcome of spatial processes of increasing returns (in the space of flows) but also as a function of important regional differences (in the space of places). As Martin (1999) has put it, "path dependence does not just 'produce' geography as in the 'new economic geography' models; places produce path dependence" (p. 80).

The way real places are conceptualised in institutional and evolutionary economics, however, is rather different. Evolutionary models typically share the assumption of neutral space with neoclassical economics, and can be criticised for this from an institutional perspective. For example, the Polya 'proportion-to-probability' models and firm demography models simulating spatial patterns of new industries assume no initial regional differences. In these models, neutral spaces are assumed to exist initially, as in new economic geography models, and a combination of historical accidents and increasing returns create a spatial pattern. However, in more applied evolutionary approaches, evolutionary economics emphasis that the central concepts of bounded rationality and localised search can, in principle, be extended towards the geographical realm of analysis (Boschma and Lambooy 1999; Essleztbichler 2002; Klepper 2002a; cf. Pred 1966). Agents innovative in directions constrained by routines that have been build over *time* and within a particular geographically localised context. What is more, this context co-evolves with economic development as technological change put institutional and social structure under pressure. Thus, despite being a contextual approach, an evolutionary approach is always cautious not to overestimate the role of the environment as a determinant of economic dynamics. Organisations and their surrounding environment co-evolve over time: territory-specific assets are constantly transformed, upgraded, or they get locked-in by the actions and repeated interactions of local agents. That is, organisations continually adapt and transform, intentionally or not, their environment (Metcalfe, 1994).

In particular, the evolutionary approach argues that the selection pressure of existing spatial structures is rather weak when new industries emerge (Boschma and Van der Knaap, 1997). Under certain circumstances, there are good reasons to assume that place-specific features do not determine the location

of new sectors. The environment is considered to be of minor importance at the initial stage of development of a sector when there exists a gap between the requirements of the new industry (in terms of knowledge, skills, etc.) and its surrounding environment. Windows of locational opportunity are open in emerging industries. Historical accidents, creative strategies of new industries, and increasing returns, are considered to drive the agglomeration outcomes. In principle, this may be based on purely evolutionary mechanisms, in which routines and knowledge are reproduced between organizations by labour mobility, supplier-buyer linkages, spin-offs, etc. However, non-evolutionary mechanisms may also stimulate this self-reinforcing process, such as the increase of more specialized suppliers, better infrastructure and a more diversified labour market. As such, a supportive regional environment (such as a specific knowledge base and institutional set-up) is more likely the outcome of a long process of co-evolution rather than the determinant of such a process. For example, the favourable institutions for Germany's chemical industries were constructed during the process of industry formation (van den Belt and Rip 1987). Utmost, space plays a generic role (such as labour markets with generic skills), which only becomes specific and supportive in those areas in which some critical mass of firms already emerged.[4] This also explains why the assumption of empty spaces in evolutionary models, which address the evolution of new industries, is justified, while the same assumption is more questionable when dealing with economy's as a whole.

Where institutional and evolutionary approaches to some extent diverge is that institutionalists view territories as units with particular institutions that affect the nature of economic activity, evolutionary economic geography views the region as an entity that is not pre-defined. Comparative analysis is only of limited use in an evolutionary framework, because economic performance is supposed to be related more to routines and knowledge built up in the past rather than the present state of institutions. Space matters almost automatically in institutional economic geography, being basically an approach in which macro-structures (i.e. institutions) determine the behaviour of agents, and the intensity and nature of relations between actors at the micro-level. Space may matter in evolutionary economic geography, but not necessarily, because spatial patterns can also be the outcome of a combination of chance events, human agency and increasing returns (Boschma and Lambooy, 1999). Moreover, evolutionary economic geography accounts for contingency, which means space may influence, but does not determine actions and relations between agents. As such, an evolutionary approach focuses on the dynamic interplay between macro (structure) and micro (agency) that gives specific outcomes in different places. To put it differently, the institutionalist approach takes the region as unit of analysis from the very start (it is more about 'space of places'), while in an evolutionary approach, a place becomes especially relevant at the end of the analysis as a node in a 'space of flows'. This conceptualisation of space comes close to what Bathelt and Gluckler (2003) have described as the main focus of 'relational economic geography', that is, the evolution of relations between economic agents in space.

Evolutionary economics also suggests that comparative analysis of places, as a benchmarking exercise, is limited. Since the knowledge and competence base tends to accumulate, and the institutional setting is quite durable due to its systemic nature and high sunk costs, both assets are intangible forces that are reproduced in the course of time, but are hard to copy or imitate by outsiders (Gertler, 2003). The core

[4] These expectations are confirmed in a recent study of the Dutch software industry (Boschma and Weterings, 2004). The emerging spatial pattern of this industry in the Netherlands could be best explained by a combination of dynamic capabilities of firms (capacity to solve problems), spin-off dynamics (spin-offs inheriting successful routines of parents in terms of background in ICT-business) and urbanisation economies (availability of labour with generic ICT-skills).

problem of policy by imitation concerns the high degree of tacitness and (often subtle) interdependencies that exist between the different factors contributing to a successful model. This implies that imitation of a subset of factors is likely to fail, because of the mismatch between the new subset and the existing structures and routines.[5] The historical trajectory of a territory sets serious limits on copying an external model that owed its success to its deep roots in an alien environment (Zysman 1994; Rivkin 2000).

Even though comparative analysis has its critics within evolutionary economics, the innovation system approach has its roots in evolutionary economics (Lundvall, 1988; Nelson, 1993; Edquist 1997). Perhaps ironically, the innovation systems approach has many characteristics of a truly institutional economic geography approach outlined above. It aims to uncover the institutional setting that more or less determines what kind of organizations and interaction patterns in a territory are involved in the innovation process. For this reason, it takes the role of institutions for granted, and tries to link differential performance to different institutional settings. It is quite common for this body of literature to associate an innovation system with a particular spatial level *a priori*, as is illustrated by notions like national and regional innovation systems. However, evolutionary economists reason from routines being embedded in firms and its relations. Then, the region as a unit of analysis is problematic, though not without meaning, as there is no strong reason to assume that routines are place-specific (Boschma 2004). Rather, some regions may be characterised by a strong degree of homogeneity in routines while other may not. This is why a more evolutionary approach to innovation systems is to adopt a sectoral innovation system perspective. Breschi and Malerba (1997) and Breschi (2000), for instance, stress the specificity of sectoral systems and their similarities across different regions. Such an approach also suggests that the history of innovation systems, in specific places, should be understood from a *dynamic* sectoral analysis, by analysing how institutions have co-evolved with the emergence of a new sector (cf. Galli and Teubal, 1997). Since the implementation and diffusion of novelty often requires the restructuring of old institutions and the establishment of new institutions (Freeman and Perez, 1988), the main issue is to what extent institutions are flexible and responsive to changes in different places. A well-known example is the rise of the synthetic dye industry in the second half of the nineteenth century, which required many institutional changes (mainly patent laws and new scientific and educational organisations), which Germany succeeded to implement, but the UK and the US, did not (Van den Belt and Rip, 1987; Murmann, 2003).[6] Institutional differences between regions or nations, in this view, are part of the *explananda*, as institutions co-evolve with processes of technological innovation and industrial dynamics. Put differently, 'real places' emerge from innovative actions of economic agents, rather than fully determining actions of economic agents.

[5] In biology, interdependency between a system constituting elements is better known as epistasis (Frenken 2004).

[6] Another example is the case of old industrial regions, which may become *locked into* rigid trajectories because their sectoral legacy of the past (in terms of resources, competences and socio-institutional structures) has weakened their ability to develop new promising activities. Although the concept of lock-in at the territorial level is still largely underdeveloped, it sheds light on the way restructuring may succeed or fail in particular regional settings. In this respect, it is fruitful to distinguish between different forms of lock-in on the cognitive, organisational and political level. Evolutionary economists stress cognitive lock-in as routines are based on particular technological paradigm (Dosi 1982). Geographers (Camagni 1991), who showed that also stress organisational lock-in, and argue that a higher number of relations with other organizations reduces the danger of lock-in, including non-local linkages granting access to knowledge and resources in the outside world. Finally, political inertia stems from vested interests in the political-economic realm actively opposing change (Grabher 1993). Depending on the strengths of these different forms of lock-in, old industrial regions may face distinct problems and different options for transition.

5. Towards an evolutionary economic geography

In essence, evolutionary economic geography is about economic change in time and space, and it does so from a unique perspective (summarised in table 2). Different from neoclassical and institutional approaches, it views the behaviour of agents as conditioned, but not determined by price differentials (neoclassical view) or institutions (institutional view). Rather, the behaviour of firms is best explained by analysing a firm's organisational routines, which it has acquired through its past activities. Change in routines by innovation is primarily triggered by unsatisfactory performance, and, is fundamentally failure-prone. Industrial dynamics thus follow from differential performance of firms caused by the heterogeneity in their routines.

Different from neoclassical and institutional approaches, an evolutionary economic geography analyses derives spatial dynamics at the levels of sectors, rather than the economy as a whole (neoclassical view) or a specific geographical area (institutional view). The understanding of the spatial evolution of an industry includes the analysis of industrial dynamics (entry and exits, product lifecycle), locational dynamics (location of entry, spin-off, exit, and migration), and agglomeration economies (in particular, knowledge spillovers in social networks). Such a sector analysis provides the bridge between micro and macro in that firm behaviour is to be understood primarily within the context of its immediate competitive environment (sector), and that macro-economic dynamics, in turn, are understood from the processes of structural change taking place in all places at all times. Thus, taking the firms in sectors as the unit of analysis does not imply that evolutionary theorising has no implications for the study of regions (traditionally covered by institutional analysis) as the economy as a whole (traditionally covered by neoclassical economics). Rather, it implies that regions and economies are to be understood from sectoral dynamics.

Table 2: Summary of an evolutionary economic geography (EEG)

- EEG combines appreciative theorising (inductive) and formal modelling (deductive)
- EEG takes firms, and their routines, as the unit of analysis
- EEG assumes the behaviour and success of firms to be dependent primarily on the routines a firm (or its founder) has built up in the past (path dependence)
- EEG views the traditional determinants of firm (location) behaviour being price signals (neoclassical) and place-specific institutions as conditioning the range of possible behaviours, and not determining observable behaviour
- EEG takes a multi-level approach allowing spatial regimes at different levels of analysis to condition firm behaviour and performance
- EEG views institutions as primarily influencing innovation in a generic sense, and as co-evolving with technologies over time and differently so in different regions
- EEG explains (regional) economic development from the dynamics of structural change at the sectoral level and institutional adaptation at multiple territorial levels

Having analysed the similarities and differences between evolutionary and neoclassical economic geography and between evolutionary and institutional economic geography, we can conclude that evolutionary and neoclassical approaches share the concept of neutral spaces, while evolutionary and institutional approaches share the emphasis on real places. This seemingly paradoxical conclusion can be understood from the explicit dynamic nature of evolutionary theorising that aims to explain how real places emerge in neutral spaces, i.e. how spatio-economic structures evolve from contingent yet self-reinforcing process. In this view, institutional specificity is an outcome of evolutionary processes of technological change that in turn trigger institutional change. This is why we would argue that the central notion of innovation systems (and related concepts), uniting evolutionary and institutional approaches, should not be taken in a structuralist fashion (as an *explanans*) determining actor's behaviour, but as structures that emerged historically (taken as an *explanandum*). In this view, innovation systems co-evolve with technological innovation and market structures, primarily, at the sectoral level.

Concerning policy discourse, it is important to remind that an evolutionary analysis is largely incompatible with comparative analysis dominant both in neoclassical economics (convergence literature) and institutional economics (comparing different models of capitalism). Differences between territories can only be understood as an outcome of a long-term evolutionary process, during which the knowledge and routines have become embedded in firms' routines and territories' institutions. Imitation (or 'transplantation') of successful routines or institutions is inherently difficult and, more importantly, the effects are expected to be very different depending on the set of routines and institutions in which it is introduced. This perspective has fundamental implications for policy. In short, policies should no longer per geared towards stated objectives and pre-planned paths towards these, but towards strengthening the adaptive capabilities ('dynamic capabilities') of firms and other economic agents, including labour, consumers, research institutions, who set their own goals and pursue their own strategies.

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